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NATIONAL IRANIAN OIL REFINING & DISTRIBUTION COMPANY  
NATIONAL IRANIAN OIL ENGINEERING  
& CONSTRUCTION COMPANY

# NIOEC SP

## NIOEC SPECIFICATION FOR PRESSURE AND VACUUM RELIEF DEVICES

FIRST EDITION

FEB. 2006

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## REVISION INDEX

| REV.<br>PAGE | 1 | 2 | 3 | 4 | 5 | REV.<br>PAGE | 1 | 2 | 3 | 4 | 5 | REV.<br>PAGE | 1 | 2 | 3 | 4 | 5 | REV.<br>PAGE | 1 | 2 | 3 | 4 | 5 |
|--------------|---|---|---|---|---|--------------|---|---|---|---|---|--------------|---|---|---|---|---|--------------|---|---|---|---|---|
| 1            | X |   |   |   |   | 26           |   |   |   |   |   | 51           |   |   |   |   |   | 76           |   |   |   |   |   |
| 2            |   |   |   |   |   | 27           |   |   |   |   |   | 52           |   |   |   |   |   | 77           |   |   |   |   |   |
| 3            | x |   |   |   |   | 28           |   |   |   |   |   | 53           |   |   |   |   |   | 78           |   |   |   |   |   |
| 4            |   |   |   |   |   | 29           |   |   |   |   |   | 54           |   |   |   |   |   | 79           |   |   |   |   |   |
| 5            | x |   |   |   |   | 30           |   |   |   |   |   | 55           |   |   |   |   |   | 80           |   |   |   |   |   |
| 6            | x |   |   |   |   | 31           |   |   |   |   |   | 56           |   |   |   |   |   | 81           |   |   |   |   |   |
| 7            | x |   |   |   |   | 32           |   |   |   |   |   | 57           |   |   |   |   |   | 82           |   |   |   |   |   |
| 8            | x |   |   |   |   | 33           |   |   |   |   |   | 58           |   |   |   |   |   | 83           |   |   |   |   |   |
| 9            |   |   |   |   |   | 34           |   |   |   |   |   | 59           |   |   |   |   |   | 84           |   |   |   |   |   |
| 10           |   |   |   |   |   | 35           |   |   |   |   |   | 60           |   |   |   |   |   | 85           |   |   |   |   |   |
| 11           |   |   |   |   |   | 36           |   |   |   |   |   | 61           |   |   |   |   |   | 86           |   |   |   |   |   |
| 12           |   |   |   |   |   | 37           |   |   |   |   |   | 62           |   |   |   |   |   | 87           |   |   |   |   |   |
| 13           |   |   |   |   |   | 38           |   |   |   |   |   | 63           |   |   |   |   |   | 88           |   |   |   |   |   |
| 14           | x |   |   |   |   | 39           |   |   |   |   |   | 64           |   |   |   |   |   | 89           |   |   |   |   |   |
| 15           | x |   |   |   |   | 40           |   |   |   |   |   | 65           |   |   |   |   |   | 90           |   |   |   |   |   |
| 16           | x |   |   |   |   | 41           |   |   |   |   |   | 66           |   |   |   |   |   | 91           |   |   |   |   |   |
| 17           | x |   |   |   |   | 42           |   |   |   |   |   | 67           |   |   |   |   |   | 92           |   |   |   |   |   |
| 18           | x |   |   |   |   | 43           |   |   |   |   |   | 68           |   |   |   |   |   | 93           |   |   |   |   |   |
| 19           |   |   |   |   |   | 44           |   |   |   |   |   | 69           |   |   |   |   |   | 94           |   |   |   |   |   |
| 20           |   |   |   |   |   | 45           |   |   |   |   |   | 70           |   |   |   |   |   | 95           |   |   |   |   |   |
| 21           |   |   |   |   |   | 46           | x |   |   |   |   | 71           |   |   |   |   |   | 96           |   |   |   |   |   |
| 22           | x |   |   |   |   | 47           |   |   |   |   |   | 72           |   |   |   |   |   | 97           |   |   |   |   |   |
| 23           |   |   |   |   |   | 48           |   |   |   |   |   | 73           |   |   |   |   |   | 98           |   |   |   |   |   |
| 24           |   |   |   |   |   | 49           |   |   |   |   |   | 74           |   |   |   |   |   | 99           |   |   |   |   |   |
| 25           |   |   |   |   |   | 50           |   |   |   |   |   | 75           |   |   |   |   |   | 100          |   |   |   |   |   |

## NOTES:

- 1) THIS SHEET IS A RECORD OF ALL REVISIONS TO THIS SPECIFICATION.
- 2) REMARKS RELATED TO EACH REVISION SHOW A BRIEF DESCRIPTION. THESE REMARKS SHALL BE INTERPRETED IN CONJUNCTION WITH THE REVISED TEXT MARKED BY REVISION NUMBERS.
- 3) WHEN APPROVED EACH REVISION SHALL BE CONSIDERED AS A PART OF THE ORIGINAL DOCUMENT.
- 4) NUMBER OF PAGES EXCLUDES THIS SHEET AND THE COVER SHEET.

|      |            |              |              |            |              |
|------|------------|--------------|--------------|------------|--------------|
| 5    |            |              |              |            |              |
| 4    |            |              |              |            |              |
| 3    |            |              |              |            |              |
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**CONTENTS :****PAGE No.**

|                                                               |           |
|---------------------------------------------------------------|-----------|
| <b>0. INTRODUCTION.....</b>                                   | <b>3</b>  |
| <b>1. SCOPE.....</b>                                          | <b>3</b>  |
| <b>2. REFERENCES .....</b>                                    | <b>3</b>  |
| <b>3. DEFINITIONS AND TERMINOLOGY .....</b>                   | <b>4</b>  |
| <b>4. SYMBOLS AND ABBREVIATIONS .....</b>                     | <b>6</b>  |
| <b>5. UNITS.....</b>                                          | <b>7</b>  |
| <b>6. DESIGN REQUIREMENTS.....</b>                            | <b>7</b>  |
| 6.1 General.....                                              | 7         |
| 6.2 Applications of Pressure Safety Relief Valves.....        | 8         |
| 6.3 Applications of Temperature Safety Valves .....           | 11        |
| 6.4 Applications of Vacuum Safety Valves.....                 | 11        |
| 6.5 Applications of Rupture Disks .....                       | 12        |
| 6.6 Applications of Fire Relief Valves .....                  | 13        |
| 6.7 Provisions of Spare Safety Valves .....                   | 13        |
| 6.8 Emergency Vapor Depressuring Requirements .....           | 13        |
| 6.9 Dimensions .....                                          | 13        |
| 6.10 Safety Valve Caps .....                                  | 13        |
| 6.11 Safety Valve Drains .....                                | 13        |
| 6.12 Safety Valve Bonnet .....                                | 13        |
| <b>7. SELECTION OF TYPE .....</b>                             | <b>14</b> |
| 7.1 Conventional (Unbalanced) Safety Relief Valves .....      | 14        |
| 7.2 Balanced Bellows Safety Relief Valves .....               | 15        |
| 7.3 Balanced Bellows Plus Balanced Piston Safety Valves ..... | 15        |
| 7.4 Multiport Relief Valves .....                             | 15        |
| 7.5 Pilot Operated Safety Relief Valves .....                 | 16        |
| 7.6 Open Spring Type Valves .....                             | 16        |
| 7.7 Closed Spring Type Valves .....                           | 17        |
| 7.8 Safety Valves with Lifting Devices .....                  | 17        |
| 7.9 Temperature Safety Relief Valves .....                    | 17        |
| 7.10 Rupture Disks .....                                      | 17        |
| <b>8. SET PRESSURE .....</b>                                  | <b>18</b> |
| 8.1 General .....                                             | 18        |
| 8.2 Pressure Safety or Relief Valve Accumulation .....        | 18        |
| 8.3 Temperature Safety Valve Set Pressure .....               | 21        |
| 8.4 Rupture Disc Set Pressure .....                           | 21        |
| 8.5 Vacuum Relief Valve Set Pressure .....                    | 22        |
| <b>9. SIZING .....</b>                                        | <b>22</b> |
| 9.1 Pressure Safety Relief Valves .....                       | 22        |
| 9.2 Vacuum Relief Valve Sizing .....                          | 32        |
| 9.3 Temperature Safety Valve Sizing .....                     | 32        |
| 9.4 Rupture Disc Sizing .....                                 | 32        |
| 9.5 Emergency Vapor Depressuring Systems .....                | 33        |

|                                                                               |    |
|-------------------------------------------------------------------------------|----|
| <b>10. MATERIAL</b>                                                           | 33 |
| <b>10.1 General</b>                                                           | 33 |
| <b>10.2 Body and its Relative Parts</b>                                       | 33 |
| 10.3 Spring                                                                   | 33 |
| <b>10.4 Internal Parts</b>                                                    | 33 |
| <b>11. ARRANGEMENT OF SAFETY RELIEF VALVES</b>                                | 36 |
| <b>11.1 General</b>                                                           | 36 |
| <b>11.2 Location on Vessels</b>                                               | 37 |
| <b>11.3 Location of Safety Valve Nozzles to Minimize Turbulence</b>           | 37 |
| <b>11.4 Location of Safety Valve Nozzles to Minimize Pulsation</b>            | 37 |
| <b>11.5 Inlet Piping of Safety Relief Valves</b>                              | 37 |
| <b>11.6 Discharge Piping of Safety Relief Valves</b>                          | 38 |
| <b>11.7 Block Valves</b>                                                      | 39 |
| <b>11.8 Discharge Piping Support</b>                                          | 40 |
| <b>11.9 Position</b>                                                          | 41 |
| <b>11.10 Discharge Piping of Temperature Safety Valves</b>                    | 41 |
| <b>12. VENTING AND DRAINING PHILOSOPHY</b>                                    | 41 |
| <b>12.1 Vapor Venting</b>                                                     | 41 |
| <b>12.2 Liquid Venting</b>                                                    | 42 |
| <b>12.3 Safety Valve Bonnet Venting</b>                                       | 42 |
| <b>12.4 Safety Valve Draining</b>                                             | 43 |
| <b>13. INSPECTION AND SHOP TESTS</b>                                          | 41 |
| <b>13.1 Inspection</b>                                                        | 43 |
| <b>13.2 Shop Tests</b>                                                        | 40 |
| <b>14. MARKING, DOCUMENTATION AND PREPARATION FOR SHIPMENT</b>                | 41 |
| <b>14.1 Body Marking</b>                                                      | 41 |
| <b>14.2 Nameplate</b>                                                         | 41 |
| <b>14.3 Documentation</b>                                                     | 42 |
| <b>14.4 Preparation for Shipment</b>                                          | 42 |
| <b>APPENDICES:</b>                                                            |    |
| <b>APPENDIX A TYPICAL PRESSURE SAFETY RELIEF VALVES LOAD SUMMARY TABLE</b>    | 44 |
| <b>APPENDIX B PRESSURE RELIEF VALVE SPECIFICATION SHEET</b>                   | 45 |
| <b>APPENDIX C GENERAL SPECIFICATION FOR SPRINGS OF PRESSURE RELIEF VALVES</b> | 47 |

## 0. INTRODUCTION

Pressure and vacuum safety relief devices are normally used to terminate an abnormal internal or external rise in pressure above a predetermined design value in boilers, pressure vessels and related piping and process equipment. Pressure relief valves or rupture discs may be used independently or in combination to provide the required protection against excessive over pressure. As used in this NIOEC Specification, the term pressure relief valves include safety valves, relief valves, and safety relief valves.

## 1. SCOPE

**1.1** This NIOEC Specification covers the minimum requirements for process and mechanical design, material selection, fabrication, inspection and shop test of pressure and vacuum safety relief devices in addition to the requirements stipulated in NIOEC Specification [NIOEC-SP-00-50](#) "Design Criteria". In case of conflict between the contents of this Specification and [NIOEC-SP-00-50](#), the latter shall be preceded.

**1.2** Pressure and vacuum relieving devices include pressure relief valves, rupture disks, vacuum relief valves, and single units composed of both pressure and vacuum relief sides. Other types of relief devices are not within the scope of this Specification.

**1.3** For installation, recommendations on pressure relieving devices, reference is made to Part 2 of API Recommended Practice RP-520.

**1.4** For the rating and adjustment of safety valves on power boilers refer to the ASME Boiler and Pressure Vessel Code, Section I, "Power Boilers".

## 2. REFERENCES

Throughout this Specification, the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this Specification. For undated references, the latest edition of the referenced document (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall mutually be agreed upon by the Company and the Vendor/Contractor.

### API (AMERICAN PETROLEUM INSTITUTE)

|                                                       |                                                                                           |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------|
| <b>RP 520,</b>                                        | "Sizing, Selection and Installation of Pressure-Relieving Devices in Refineries"          |
| - Part I, 7 <sup>th</sup> . Ed., Jan. 2000            | "Sizing and Selection"                                                                    |
| - Part II, 4 <sup>th</sup> . Ed., Dec. 1994           | "Installation"                                                                            |
| <b>RP 521,</b> 4 <sup>th</sup> . Ed., March 1997      | "Guide for Pressure-Relieving and Depressuring Systems"                                   |
| <b>Standard 526,</b> 5 <sup>th</sup> . Ed., 2002      | "Flanged Steel Pressure-Relief Valves"                                                    |
| <b>Standard 527,</b> 3 <sup>rd</sup> . Ed., 1991      | "Seat Tightness of Pressure Relief Valves"                                                |
| <b>Standard 2000,</b> 5 <sup>th</sup> Ed., April 1998 | "Venting Atmospheric and Low-Pressure Storage Tank Nonrefrigerated-Ted and Refrigerated)" |

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**ASME (AMERICAN SOCIETY OF MECHANICAL ENGINEERS)****ASME Boiler and Pressure Vessel Code:**

- Section I: "Power Boilers"
- Section VIII: "Pressure Vessels"
- Section VIII: "UG 134"
- ASME B31.3** "Process Piping"

**NACE (NATIONAL ASSOCIATION OF CORROSION ENGINEERS)**

NACE Standard MR 0103-2003 "Standard Material Requirements - Material  
Resistant to Sulfide Stress Cracking in  
Corrosive Petroleum Refining Environments"

**NEC (NATIONAL ELECTRICAL CODE)**

Division 2 "Electrical Classification Areas"

**NIOEC-SP (NIOEC SPECIFICATIONS)**

- [NIOEC-SP-00-10](#) "NIOEC Specification for Units"
- [NIOEC-SP-00-50](#) "NIOEC Specification for Design Criteria"

**3. DEFINITIONS AND TERMINOLOGY****3.1 Accumulation**

Pressure increase over the maximum allowable working pressure of the vessel during discharge through the pressure relief valve (expressed as a percent of that pressure) is called accumulation.

**3.2 Back Pressure**

Pressure on the discharge side of safety-relief valves is back pressure.

**3.2.1 Built-Up back pressure**

Built-up back pressure is the pressure in the discharge header which develops as a result of flow after that the safety relief valve opens.

**3.2.2 Superimposed back pressure**

Superimposed back pressure is the pressure in the discharge header before the safety-relief valve opens.

**3.3 Blowdown**

Difference between set pressure and reseating pressure of a safety valve expressed in percent of the set pressure or in bar or kPa.

### 3.4 Design Pressure

The pressure used or designated in the design of equipment for the purpose of determining the minimum permissible thickness of the pressure parts at a designated temperature, exclusive of any thickness allowances added for corrosion and for loadings other than pressure.

### 3.5 Maximum Allowable Working Pressure

As defined in the construction codes for pressure vessels, the maximum allowable working pressure depends on the type of material, its thickness and the service conditions set as the basis for design. The vessel may not be operated above this pressure or its equivalent at any metal temperature other than that used in its design. Consequently, for that metal temperature, it is the highest pressure at which the primary pressure-relief valve is set to open.

### 3.6 Overpressure

Pressure increase over the set pressure of the relieving device is overpressure. It is the same as accumulation when the relieving device is set at the maximum allowable working pressure of the vessel and may be greater than the allowable accumulation if the valve is set lower than the vessel MAWP.

### 3.7 Relief Valve

A relief valve is an automatic pressure-relieving device actuated by the static pressure upstream of the valve. The valve opens in proportion to the increase in pressure over the opening pressure. It is used primarily for liquid service.

### 3.8 Safety Valve

A safety valve is an automatic pressure-relieving device actuated by the static pressure upstream of the valve and characterized by rapid full opening or pop action. It is used for gas or vapor services.

### 3.9 Reseating Pressure of a Safety Valve

The values of inlet static pressure at which the disc re-establishes contact with the seat or at which lift becomes zero.

### 3.10 Rupture Disk

A rupture disk consists of a thin metal diaphragm held between flanges and bursts when a predetermined pressure is reached below the disk, so preventing a predetermined safe pressure being exceeded in the vessel to be protected.

### 3.11 Safety-Relief Valve

A safety-relief valve is an automatic pressure-relieving device suitable for use as either a safety or relief valve, depending on application. It is used in either gas and vapor or liquid services.

### 3.11.1 Direct loaded safety-relief valve

A safety-relief valve in which the loading due to the fluid pressure underneath the valve disk is opposed only by direct mechanical loading such as a mass, a lever and mass, or a spring.

### 3.11.2 Pilot operated safety-relief valve (indirect loaded safety-relief valve)

A safety-relief valve, the operation of which is initiated and controlled by the fluid discharged from a pilot valve which is itself a direct loaded safety-relief valve subject to the requirements of this Standard.

### 3.11.3 Balanced bellows safety-relief valve

A valve incorporating a bellows which has an effective area equal to that of the valve seat to eliminate the effect of back pressure on the set pressure of the valve and which effectively prevents the discharging fluid entering the bonnet space.

### 3.11.4 Conventional safety-relief valve

A valve of the direct loaded type, the set pressure of which will be affected by changes in the superimposed back pressure.

## 3.12 Set Pressure

Inlet pressure to which a safety valve is adjusted, in a test stand or other source of pressure, to open with an atmospheric discharge or atmospheric back pressure.

## 3.13 Vacuum Relief Valves

Vacuum Relief Valves are usually installed on storage tanks and shall normally be of the mass loaded or pilot operated type. For full description and determination of size of vacuum relief valves reference shall be made to API 2000 "Venting Atmospheric and Low Pressure Storage Tanks (Non-Refrigerated and Refrigerated)".

## 4. SYMBOLS AND ABBREVIATIONS

|                   |                                      |
|-------------------|--------------------------------------|
| <b>Con.</b>       | Contractor.                          |
| <b>DN</b>         | Diameter Nominal, in (mm).           |
| <b>DP</b>         | Design Pressure.                     |
| <b>F</b>          | Environment Factor.                  |
| <b>L</b>          | Liquid.                              |
| <b>LSAP</b>       | Limiting System Allowable Pressure.  |
| <b>MAWP</b>       | Maximum Allowable Working Pressure.  |
| <b>MRP</b>        | Maximum Relief (Relieving) Pressure. |
| <b>NEC</b>        | National Electrical Code.            |
| <b>OGP</b>        | Oil, Gas and Petrochemical.          |
| <b>P &amp; ID</b> | Piping & Instrumentation Diagram.    |
| <b>RF</b>         | Raise Face.                          |

---

|            |                                  |
|------------|----------------------------------|
| <b>SP</b>  | Set Pressure.                    |
| <b>TRC</b> | Temperature Recorder Controller. |
| <b>V</b>   | Vapor.                           |

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## 5. UNITS

International System of Units (SI) in accordance with [NIOEC-SP-00-10](#) shall be used, unless otherwise specified.

## 6. DESIGN REQUIREMENTS

### 6.1 General

**6.1.1** Safety relief valves shall be provided to protect all equipment subject to overpressure and under certain other conditions as specified herein.

**6.1.2** Unless otherwise specified in this Specification, the safety devices shall be provided when the overpressure exceeds the design pressure of the equipment.

**6.1.3** ASME Code stamp is required for all pressure relieving devices except for the cases not required in the relevant data sheet.

**6.1.4** The pressure relieving devices shall be designed in accordance with the following codes and standards:

API-RP 520 "Design and Installation of Pressure Relieving Systems in Refineries".

- **Part I** : Design

- **Part II**: Installation

API Standard 526 "Flanged Steel Safety Relief Valves".

API Standard 527 " Seat Tightness of Pressure Relief Valves "

ASME Boiler and Pressure Vessel Code:

-**Section I**: Power Boilers

-**Section VIII**: Pressure Vessels

[NIOEC-SP-00-50](#) "NIOEC Specification for Process and Mechanic Design Criteria".

**6.1.5** The design of pressure and vacuum relief devices for storage tanks should be in accordance with API Standard 2000 "Venting Atmospheric and Low pressure Storage Tanks (Non-Refrigerated and Refrigerated), unless otherwise specified in this Standard.

**6.1.6** The required orifice area shall be determined in accordance with API Recommended Practice 520 Part I Appendix C.

**6.1.7** All safety relief valves shall be provided with pressure tight bonnets except balanced type valves and the valves in steam and hot water services. The safety relief valves in steam and hot water services shall be provided with open bonnets.

**6.1.8** Springs are usually designed and fabricated to the manufacturers own standards. A general specification for springs of pressure relief valves are given in Appendix B of this standard as a guide. The Appendix covers design, material, testing, dimensional checks and tolerances.

**6.1.9** Snuffing steam shall be provided for safety valves discharging to atmosphere in the following services:

a) Material above its auto-ignition point.

b) Light hydrocarbon service at locations listed in the job specification where hazard of exposure to lightning is prevalent due to high rate of electrical storms.

When snuffing steam is required, provide a DN 25 (one inch) snuffing steam connection approximately 300 mm from outlet end of the discharge piping. The steam line to this connection shall be run to grade, provided with a double valve and bleeder at grade and a steam condensate trap upstream of the double valves.

**6.1.10** All pressure relief valves (except thermal relief valves) with the inlet nozzle size of DN 25 (1 in.) and larger should be flanged, spring loaded, high lift, high capacity type with a top guided disc. Pressure relief valves with the inlet nozzle size under DN 25 may be of the screwed type connection.

## **6.2 Applications of Pressure Safety Relief Valves**

Pressure safety or relief valve shall be provided for all cases as specified herein below.

### **6.2.1 Vessels**

**6.2.1.1** When designed in accordance with Section VIII, ASME Unfired Pressure Vessel Code and the overpressure exceeds the Design Pressure.

Special attention shall be made to the cases, where process conditions are changed during the engineering stage or after initial start-up of the plant and require increased operating pressure.

**6.2.1.2** When designed in accordance with Section I, ASME Power Boiler Code and the overpressure exceeds the Maximum Allowable Working Pressure as defined in that code.

### **6.2.2 Pumps**

**6.2.2.1** On discharge of positive displacement pumps.

**6.2.2.2** On discharge of centrifugal pumps to protect downstream equipment from overpressure based on pump shutoff pressure.

**6.2.2.3** On discharge of all pumps where under blocked discharge, the horsepower rating (in kilowatts) of the electric motor drive may be exceeded.

**6.2.2.4** On pump suction lines from a "bottled in" system where overpressure can be imposed on suction piping by backflow through the pump or through a control valve bypassing from pump discharge to suction.

### **6.2.3 Compressors**

**6.2.3.1** Where each stage of reciprocating compressors to protect interstage, intercooler, compressor frame or cylinder.

**6.2.3.2** On suction lines where overpressure may occur on suction lines or frame, or overload electric motor driver before interstage or discharge safety valve opens. Also for conditions specified in Clause 6.2.2.4 above.

#### **6.2.4 Compressor & pump couplings**

**6.2.4.1** On discharge where under blocked discharge the design torque of the driver coupling or keyway may be exceeded due to an oversized motor or turbine.

#### **6.2.5 Steam boilers & superheaters**

**6.2.5.1** The following equipment falling under the jurisdiction of Section I, ASME Power Boiler Code when the overpressure exceeds the Maximum Allowable Working Pressure as defined by that Code:

- a) Steam drums.
- b) Superheater outlet.
- c) Externally fired superheater coils installed in a process heater.

#### **6.2.6 Fired process heaters**

**6.2.6.1** To prevent overpressure due to heat input resulting from an action blocking the lines at downstream of the heater, where check valves or other valves upstream of the heater are closed by the same action blocking the upstream line(s), except for the condition covered under (a) below. The safety valve may be located anywhere between the upstream and downstream blocking valves:

- a) A safety valve will not be required to protect the heater if the only block valve(s) between a fired heater and a tower are operable manually and intended to be used to prevent backflow from the tower to the heater in case of heater tube failure.

#### **6.2.7 Turbines & surface condensers**

**6.2.7.1** Condensing or non-condensing steam turbine cases where the exhaust outlet may be blocked, thus preventing the turbine from discharging to atmosphere, a low pressure steam header or a surface condenser.

**6.2.7.2** Gas turbine cases, where exhaust outlet is blocked, thus preventing the turbine from exhausting to atmosphere, or to waste heat generators, etc.

**6.2.7.3** Exhaust outlet where the design pressure of an expansion joint is less than the turbine casing design pressure.

**6.2.7.4** Surface condensers for condensing turbines.

#### **6.2.8 Piping & connected equipment**

**6.2.8.1** For protection of piping, heat exchangers and other equipment served by the piping against overpressure under the following conditions:

- a) Downstream of steam reducing valves (including protection to steam engine and turbine drivers in this case).
- b) On the exhaust steam header leaving a Unit regardless of overpressure considerations. Use a chain operated multiport relief valve located on the Unit side of the block valve where the

header connects into the plant exhaust steam system.

- c) Downstream of restriction orifices or manually operated valves in steam make-up or other services where closing a valve would result in overpressure.
- d) Fuel inlet to gas engine drivers.
- e) Pressure line to pressure balanced valves used to control fuel supply where the steam breaking point, diaphragm bursting point or diaphragm case breaking point may be exceeded.
- f) Downstream of steam control or regulating valves.
- g) Downstream or upstream of all control valves when the piping or equipment would be subjected to overpressure assuming that the control valve will fail in the open or closed position.
- h) On pedestal or gland water systems to pumps and turbines where overpressure is caused by water pump shutoff pressure. One safety valve may be provided on the supply line to a group of pumps, turbine glands or pedestals in lieu of a safety valve on the line to each equipment.
- i) Overpressure resulting from any of the conditions outlined in Clauses 6.2.1 through 6.2.7.

### 6.2.9 Cold side blockage & tube failure in exchangers

**6.2.9.1** To prevent overpressure due to heat input resulting from an action blocking the line(s) downstream of the cold side of the exchanger, where check valves or other valves upstream of the exchanger are closed by the same action blocking the upstream line(s). A safety valve is required where heating the cold fluid within the exchanger when the hot side inlet temperature will raise the pressure of the fluid contained between the upstream and downstream blockages to more than 1.3 times of the design pressure of any item of equipment (excluding piping) in the contained system.

### 6.2.10 Pressure safety relief valves not required

Pressure safety relief valves shall not be provided on the following systems:

- a) Interconnected vessels (excluding those falling under the requirements of Section I ASME Power Boiler Code), if they meet the following conditions:
  - a.1) The vessel which is the source of pressure shall be equipped with a safety valve sized to protect all of the interconnected vessels or requirement and the interconnected piping (including heat exchanger equipment) shall be sized or checked for pressure drop to insure that the design pressure on the downstream vessel or vessels is not exceeded by more than the percentage accumulations allowed in Clause 8.2.1.
  - a.2) At least one interconnecting piping system between the protected vessel and any other vessel must be free of:
    - Any equipment which may fail or stop in a closed position.
    - Any block valves control or check valves.
    - Any orifices or similar restrictions to flow.
- b) Where a lower pressure piping system such as pumpout is routed to an offsite slop or emergency tank with overshoot connections (connections entering the top of the tank without block valves).

- c) Depressuring systems routed to a flare, if all valves at the Unit limit, cooling boxes, or downstream depressuring valves are locked open.

### 6.3 Applications of Temperature Safety Valves

Temperature safety valve shall be provided for all cases as required herein below:

#### 6.3.1 Heat exchangers

Temperature safety valves shall be provided on the cold side of heat exchange equipment, including compressor jackets operating full of liquid and subject to being blocked off, where heat may be applied internally or externally and other forms of pressure relief valves are not provided.

#### 6.3.2 Piping

Provide temperature safety valves for the following:

- a) **Steam traced lines**

For sections of pipe which are steam traced and contains liquid and may be blocked in.

- b) **Lines containing cold solvent or refrigerant**

For blocked in sections of pipe which contain cold liquid and may develop excessive pressure under ambient temperature.

- c) **Exposed liquid-filled lines**

For blocked in sections of pipe which may be subjected to excessive pressure due to rays of sun when exposed length of line is 30 meters or greater.

#### 6.3.3 Temperature safety valves not required

On pedestal or gland water piping to pumps, turbines, compressors, blowers, etc. when the improbability that blocking off both the inlet and outlet valves and heating of the glands would occur simultaneously temperature safety valve is not required.

### 6.4 Applications of Vacuum Safety Valves

#### 6.4.1 Pressure vessels

6.4.1.1 Vessels in the following services shall be provided with vacuum breaking device, if they cannot withstand full vacuum:

- a) Vessels where stripping steam is used and overhead condensing systems are provided.
- b) Vessels operating under partial vacuum.
- c) Vessels operating full of liquid having a vapor pressure less than atmospheric pressure at the operating temperature.
- d) Vessels on suction to compressors.
- e) Vessels such as hot process softeners, deaerating heaters, hot water storages where cold water is heated by direct contact with steam and the vessel is not open to atmosphere.

**6.4.1.2** Before vacuum safety valves are provided for vessels where explosive mixtures may occur due to bleeding air into the vessel through a vacuum safety valve and if the set pressure of the vacuum relief valve is so low that special consideration is needed to hold leakage to a minimum, consideration should be given to the alternate method of bleeding gas into the vessel by means of a regulator or control valve using the bleed gas as the operating medium instead of instrument air.

**6.4.1.3** Vacuum relief valves allowing air to enter a hydrocarbon system shall not be used without prior approval of the Company. The Contractor shall provide adequate back up documents to support the design applied to the system.

## **6.4.2 Spheres & spheroids**

**6.4.2.1** The necessity for vacuum relief valves on spheres and spheroids shall be investigated for each case, depending on the vapor pressure and corrosivity of the fluid handled and design of such equipment in regard to vacuum.

**6.4.2.2** When required the precautions specified under Clauses 6.4.1.2 and 6.4.1.3 above shall be observed.

## **6.5 Applications of Rupture Disks**

### **6.5.1 Rupture disk alone**

A rupture disk alone shall not be used to protect vessels or equipment but it may be used in combination with safety valves as a second relief device.

### **6.5.2 Rupture disk on inlet to safety valve**

A rupture disk shall be provided at the inlet to a safety valve in the following instances:

- a)** Where it is difficult to keep safety valves from leaking either due to high pressure involved or to combination of high pressure and fluctuating pressure such as high pressure reciprocating compressors.
- b)** Where toxic material is being handled and contamination of the atmosphere is to be avoided due to possible leakage.
- c)** Where the fluid handled is expensive and possibility of safety valve leakage is to be avoided.
- d)** Where material which will make the safety valve inoperative is to be kept out of the safety valve.
- e)** Where corrosive material is handled and a safety valve can not be obtained of satisfactory material to resist corrosion.
- f)** Where corrosive material is handled and cost of safety valve to resist corrosion is prohibitive.

### **6.5.3 Rupture disk on outlet of safety valve**

Rupture disks shall be provided on outlet of safety valves in the following instances:

- a)** To keep corrosive product out of a safety valve connected into a vent system.
- b)** Where it is necessary to confine safety valve leakage and there is insufficient space available on safety valve inlet.

#### **6.5.4 Rupture disks used in conjunction with safety valves**

Rupture disks shall be provided in parallel with safety valves which discharge to the atmosphere or to a vent system under the following conditions:

- a) Where exothermic reactions may develop abnormally high and uncontrollable pressure conditions.

#### **6.6 Applications of Fire Relief Valves**

Fire relief valves shall be considered for liquid containing equipment, (e.g., vessels, columns and settlers) if all of the following circumstances apply:

- a) If the equipment is located in an area where a sizable fire may occur.
- b) If the equipment under consideration can be blocked in, while the Unit remains in operation.

#### **6.7 Provision of Spare Safety Valves**

**6.7.1** The necessity for provision of spare safety valves shall be based upon the following considerations:

- a) On process Units where the required time interval between safety valve inspection periods is less than the time interval between designated inspection and test periods of the Unit, or is less than the normally anticipated frequency of Unit shut-downs for other reasons such as clean up or catalyst change, and the vessel or item of equipment can not be taken out of service without shutting down the Unit.

**6.7.2** When a spare safety valve is required, the size of the safety valves shall be such as to provide the least number of safety valves which will have a total capacity equal or greater than the calculated required relieving capacity.

**6.7.3** A spare relief valve is not required when two or more pressure or safety relief valves are required for the calculated relieving capacity on spheres or spheroids. However, where only one valve is needed for the required capacity, a spare valve shall be provided for spheres or spheroids.

When a vacuum relief valve or valves are required on spheres or spheroids, no spare relief valve is required.

**6.7.4** Spare temperature safety valves are not required.

#### **6.8 Emergency Vapor Depressuring Requirements**

**6.8.1** In addition to (not in lieu of) the pressure relief facilities described in this Section, a depressuring system shall be provided for reducing the pressure under fire conditions. To this end all process equipment, except as mentioned below, containing more than 2 metric tones of liquid C4 or more volatile liquid under normal operating conditions, shall be provided with remotely operated vapor depressuring valves discharging into a closed system, preferably the relief system, leading away from the probable fire areas.

**6.8.2** Platformate separators in platforming Units and high pressure separators in hydrotreating and hydrocracking Units shall always be provided with depressuring facilities.

**6.8.3** Facilities for remote operation of the depressuring valves shall be located in the control room.

## **6.9 Dimensions**

**6.9.1** Center-to-face dimensions shall be in accordance with API Standard 526. Flange facings and dimensions shall be in accordance with ASME/ANSI B16.5.

**6.9.2** Inlet pressure limits shall be governed by the inlet termination or the manufacturer's spring design limits, whichever is the smaller. Inlet flanges shall be capable of withstanding reaction forces due to the valve discharge in addition to the internal pressure and are therefore generally suitable for pressure and temperature lower than the ANSI ratings. Outlet pressure limits shall be determined by the valve design.

## **6.10 Safety Valve Caps**

All closed bonnet safety valves shall be furnished with screwed or bolted caps.

## **6.11 Safety Valve Drains**

Drain connections shall be provided on all safety valves used in condensable vapor service (see also Article 11.4 hereinafter).

## **6.12 Safety Valve Bonnet**

**6.12.1** Conventional safety relief valves for closed relief systems shall have a closed bonnet.

**6.12.2** Safety relief valves of the balanced type shall have a vented bonnet which shall be vented to atmosphere in such a manner as to prevent the ingress of rain and dirt. Personnel hazard should be avoided whilst on the other hand ready observation of any flow from a vent line should remain possible.

A DN 20 ( $\frac{3}{4}$  inch) minimum size vent connection shall be provided in the closed bonnet of all safety valves to vent the spring housing to the atmosphere. This is especially needed on bellows type safety valves to prevent build up of back pressure.

# **7. SELECTION OF TYPE**

## **7.1 Conventional (Unbalanced) Safety Relief Valves**

**7.1.1** Use the conventional safety relief valve where the service is:

- a) Clean and non-corrosive.
- b) Corrosive, with provision of corrosion resistant materials.

**7.1.2** Do not use this valve where service is:

- a) Corrosive and corrosive materials may damage the guide and disk, or guide and spindle or spring and bonnet.
- b) Such that the back pressure (built-up back pressure and/or variable superimposed back pressure) is greater than 10% where 10% accumulation is allowed or greater than 20% where 20% accumulation is allowed under fire conditions.

- c) Such that the differential pressure when the valve is relieving compared to the normal differential pressure across the protected equipment is less than 10%. This particularly applies when starting up a Unit where the initial back pressure on a valve is zero and the differential pressure across the valve may be below the intended operating pressure or closer than 10% above the normal operating pressure.
- d) Such that the material relieved may contain coke in suspension or slurries containing particles which may clog the guiding surfaces.

## 7.2 Balanced Bellows Safety Relief Valves

7.2.1 Use the balanced bellows safety relief valve where:

- a) The relieving pressure is to be independent of the back pressure.
- b) The bellows is used to prevent clogging of the guiding surfaces with coke or other particles in suspension.
- c) The bellows is used to prevent corrosive products from damaging the guiding surfaces, spring or associated pieces.
- d) Back pressure as specified in 7.1.2(b) and 7.1.2(c) above exists and either liquid or vapor relief is to be handled.
- e) Savings in discharge piping and size of flare header may be realized through use of higher back pressure in the flare header.

7.2.2 Where the balanced bellows safety valve is used in closed flare system and the variable back pressure is above 30 percent of the relieving pressure, check with the manufacturer on the decrease in the capacity of the particular valve when sizing. Do not use this type of safety valve where the liquid being discharged could accumulate and set up in the convolutions or bellows and make safety valve inoperative.

7.2.3 Superimposed back pressure due to operation of emergency depressuring valves shall be disregarded when evaluating the necessity of balanced type valves, since simultaneous operation of relief and depressuring valves should not normally occur. As variable back pressure the highest pressure shall be taken that can be generated in the outlet of a valve by the valve itself, and possibly other valves at the same time of blowing.

7.2.4 Bellows balanced valves shall not be used for services involving materials with their pour point at or above lowest ambient temperature (e.g., materials containing wax) or where coking may be expected. Balanced valves with a piston only shall be used in such cases.

## 7.3 Balanced Bellows plus Balanced Piston Safety Valves

The balanced piston added to a balanced bellows safety valve is to be provided where it is important that the valve operate properly in case of bellows failure. This type of valve is to be used only on approval of the Company.

## 7.4 Multiport Relief Valves

7.4.1 Use the multiport relief valve on exhaust steam systems where it is desired to open the valve manually to dump the exhaust steam to the atmosphere, or to provide protection for process Unit exhaust steam headers.

7.4.2 Multiport relief valves may also be used in vacuum service to protect surface condensers, etc. Such valves are to be water sealed.